PATENT SPECIFICATION 1,028,980

DRAWINGS ATTACHED.

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1,028,980

Date of filing Complete Specification: Dec. 19, 1962.

Application Date: July 6, 1962. No. 26064/62.

Complete Specification Published: May 11, 1966.

Index at Acceptance:—H1 A(2E3D2, 8, 13).

Int. Cl.:—H 01 b 7/08.

COMPLETE SPECIFICATION.

Improvements in Ribbon Cable.

We, THE WHITNEY BLAKE COMPANY, a Company organised and existing under the Laws of the State of Connecticut, United States of America, of New Haven, Connecticut, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to flat or ribbon cable and more particularly, to a unique construction for ribbon cable which may be cut at predetermined lengths to produce cable segments with conductor portions automatically stripped of insulation.

Flat, or "ribbon" cable as it is more commonly called, has recently become extremely popular. It is relatively easy to install and has good load capacity, good heat dissipation and is easily shielded electrically from other units.

Ribbon cable originally came into existence as an outgrowth of printed circuitry. The original manufacturing technique involved the printing of parallel lines of copper upon thin rigid plastic sheets or strips. This technique eventually advanced to the sandwiching of flat conductor material, such as copper, silver, aluminum or the like, between continuous lengths of flexible tape. The tape generally consisted of an insulating plastic such as a polyester, a polyamide, a polyaloalkane or alkene.

In making connections with such ribbon cables, short lengths were cut from the supply roll as needed and the insulation was stripped from the ends. Unfortunately, it was difficult to strip the insulation from the ends or intermediate regions of the thin flat conductors, particularly from only one side of the ribbon cable as required for junctions with many types of connector units. Complicated cutting and stripping techniques were required. In addition, damage to the conductor frequently occured.

The introduction of insulation piercing connectors overcame some of these problems, but these connectors were expensive and frequently unsuitable for use in many important applications. Until the discovery of the invention disclosed herein, the demand for ribbon cable constructed to facilitate easy connection has not been satisfactorily met.

An object of the present invention is to provide ribbon cable which, when cut in predetermined lengths or configurations, produces modular cable units having conductor portions stripped of insulation on one or both sides, and which has continuous and uninterrupted conductor-supporting portions of at least one insulating layer adjacent to the exposed portions of the conductors to provide continuous longitudinal support for the conductors.

From one aspect, the invention consists in a ribbon cable in which a plurality of electrical conductors are disposed in spaced, substantially parallel relationship throughout their length, and are sandwiched between two layers of insulating material which are bonded together, and in which one of the layers is interrupted or perforated at one or more positions therealong to expose a portion of some or all of the conductors at the or each said position, and the other layer is uninterrupted at the or each said position or is perforated at the or each position so as to leave uninterrupted portions disposed

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polyalkane or similar polymeric material will be satisfactory. However, other insulating material such as rubber, fabric, asbestos, flexible mica and the like might also be used. The tape layers with the conductors therebetween are generally bonded together by heat sealing or by an adhesive.

If desired, shielding layers, armour layers, heat resistant layers or other functioning layers may be superimposed upon the insulating tape, either before or after forming the ribbon cable.

Sandwiched between the insulating tape are flat conductors 13, 14, 15, 16, and 17 (five being shown in the embodiment illustrated in FIGURE 1). The type, the number of strips, the width, the thickness or the flatness of the conductive material is dependent upon the requirements of the user. Generally copper, silver or aluminum will be used as the conductive material.

Prior to lamination or sandwiching of the tape and the conductors into a ribbon cable, either the bottom or the top layer of tape or both, and any additional outer layers that may be superimposed thereon, are apertured or perforated at predetermined points or positions across the width and along the length of the tape. If both layers are perforated, the perforations may coincide if desired.

In the embodiment shown in FIGURES 1 and 3, the top and bottom insulating tapes incorporate coinciding aperture perforations 20, in alternate transverse columns of 5 and 1. This modular pattern permits cutting or shearing, as indicated by the dotted lines 21 and 25 into cut lengths of ribbon cable having the stepped configurations shown in FIGURE 2. It should be particularly noted that the cut ribbon cable has insulation-bare ends. Thus, stripping is not necessary.

When only one layer of tape has been perforated, the ends are bare on one side only. As indicated above, such one-sided stripping is frequently desirable in certain specific applications. In particular, where thin foil or vapor deposited metal layers form the conductor strips sandwiched in the ribbon cable, these thin metallic strips require continuous support throughout their length. Underlying support for the thin conductor strips is provided in the embodiments of FIGURES 4 through 8 by a continuous longitudinal underlying layer of insulating material which is not interrupted by apertures. With thicker conductive strips, such as the conductors illustrated in FIGURE 1, intermediate webs of insulating material spaced between the aperture perforations 20 provide the necessary continuous conductor support adjacent the conductors and between the aperture perforations, as shown in FIGURE 3.

Thus in all embodiments of the present invention, continuous longitudinal conductor support is provided either by underlying portions of the insulating layer directly supporting the conductive strip, as shown in FIGURES 4—8, or by adjacent intervening webs spaced between individual aperture perforations in one or both of the insulating layers.

The perforations are preferably rectangular in shape with the long axis in the longitudinal direction of the ribbon, permitting transverse severing along the short axes of the rectangles, such as the lines 21 of FIGURE 1, leaving pre-stripped exposed regions of the conductive elements of sufficient size for convenient connection purposes. Other aperture shapes, such as round, oval or square are obviously also possible. The rectangular configuration has the greatest use and provides the most scrap-free, trim-looking appearance.

In the embodiment shown in FIGURE 1 of the drawing, simple staggered positioning of the cutters transversely across the ribbon will cut short lengths of cable ready for immediate use. If a straight cutting edge is used, further "trim" cutting of the tab portions 22 (shown by dashed lines in FIGURE 2) may be performed if desired to eliminate these tab portions. And if longitudinally disposed cutters are simultaneously or subsequently used to make cuts, as illustrated by the dotted lines 25, the cable will be divided into short narrow lengths 26, 28, 29. The cut lengths, as shown in FIGURE 2, may have a stepped configuration with bare conductor ends 14 extending from the "riser" portions of the steps. Such cut lengths have particular utility in high-speed production assembly of electrical and electronic equipment.

The particular modular arrangement of aperture perforations and the manner of cutting governs the shape of the cut ribbon segments produced. Obviously there are innumerable patterns which can be produced using this technique, and the particular pattern will be governed by the dictates of the user. A unique method has thus been provided for making cut lengths of ribbon cable ready in any desired length or configuration for immediate use in making connections.

An added feature in the ribbon cable of FIGURES 1 and 2 provides timing means for automatic shearing. To accomplish this, an indexing tape is incorporated into the ribbon structure. In the preferred embodiment, the indexing tape consists of two outer perforated edges 24, similar in appearance to the outer edges of motion picture film.

formed. Faulty connections and conduction losses caused by incomplete stripping no longer present a problem.

Furthermore, with the uninterrupted underlying support for the thin conductor strips or layers which is provided by the underlying insulating layers of the embodiments illustrated in FIGURES 4—8, these prestripped and severed modular cable units may be employed with very thin ribbon cables incorporating extremely thin conductor elements. The techniques of this invention thus provide a way of fabricating ribbon cable segments of any desired length, shape and configuration, automatically prestripped of insulation and ready for connection to other electrical components.

WHAT WE CLAIM IS:—

1. A ribbon cable in which a plurality of electrical conductors are disposed in spaced substantially parallel relationship throughout their length and are sandwiched between two layers of insulating material which are bonded together, and in which one of the layers is interrupted or perforated at one or more positions therealong to expose portions of some or all of the conductors at the or each said position, and the other layer is uninterrupted at the or each said position or is perforated at the or each position so as to leave uninterrupted portions disposed respectively beneath or between the exposed portions of said conductors at the or each position.

2. A ribbon cable as claimed in claim 1, in which the electrical conductors are strip conductors.

3. A ribbon cable as claimed in claim 1 or 2, modified in that said one layer is provided with one or more unbonded portions at the or each position which are scored and removable from said layer to form the or each interruption or perforation.

4. A ribbon cable as claimed in claim 1 or 2, in which both layers have mutually coinciding perforations at the or each position located respectively in registration with the conductors.

5. A ribbon cable as claimed in any one of the preceding claims, including an indexing strip portion along one or each edge of the cable for the automatic control of shearing apparatus through which the cable may be passed in order to shear it.

6. A ribbon cable as claimed in any one of the preceding claims, in which at least said one layer is perforated at one or more further positions therealong to expose only one conductor at the or each further position.

7. A ribbon cable constructed substantially as hereinbefore described with reference to Figures 1, 2 and 3 of the accompanying drawings.

8. A ribbon cable constructed substantially as hereinbefore described with reference to Figure 4 of the accompanying drawings.

9. A ribbon cable constructed substantially as hereinbefore described with reference to Figures 5 and 6 of the accompanying drawings.

10. A ribbon cable constructed substantially as hereinbefore described with reference to Figures 7 and 8 of the accompanying drawings.

11. A method of producing a shorter length of cable from a supply strip of ribbon cable having a plurality of electrical conductors, which are disposed in spaced, substantially parallel relationship throughout their length, laminated between two layers of insulating material, comprising the steps of perforating or interrupting one of said layers of insulating material at one or more positions therealong prior to lamination to expose portions of some or all of the conductors at the or each position after lamination, maintaining the uninterrupted longitudinal continuity of at least a portion of the other layer of insulating material at the or each position, and subsequently shearing the resulting laminated ribbon cable transversely and at least one interrupted or perforated position to produce a multiple-conductor portion of predetermined length and configuration having prestripped insulation-free terminal connection regions thereon.

12. A method as claimed in claim 11 in which said one layer at the or each position is perforated so as to have individual perforations disposed respectively in registration with individual conductors to be exposed.

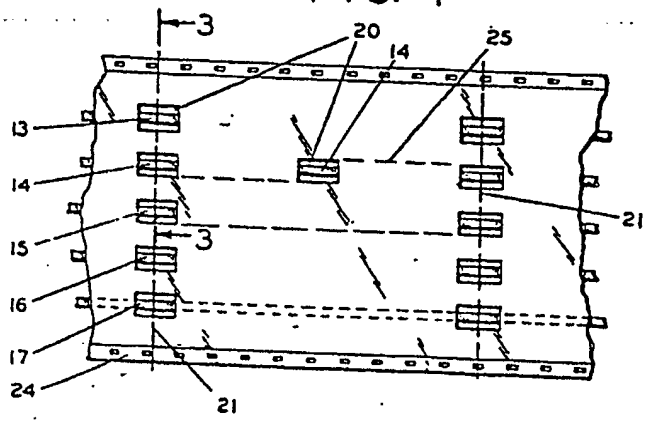
13. A method as claimed in claim 11, in which both layers are formed with mutually coinciding perforations separated by mutually coinciding uninterrupted portions of the layers at the or each position whereby both sides of the conductors are exposed without insulation at the or each position to provide pre-stripped cable portions after the severing step.

14. A method as claimed in claim 11, 12 or 13, in which the electrical conductors are strip conductors.

15. A method as claimed in claim 11, 12, 13 or 14, in which the ribbon cable is sheared at perforated positions therealong to produce a portion of cable having at least one end of stepped configuration and conductors of different lengths.

16. A method of producing a shorter length of cable from a supply strip of ribbon

FIG. 1



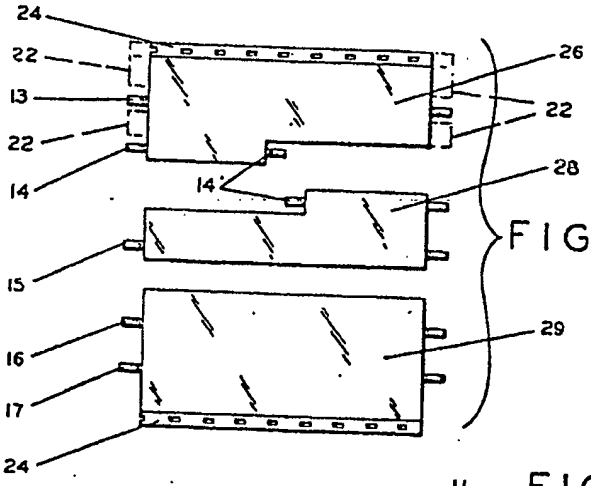


FIG. 2

FIG. 3

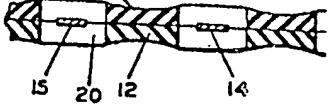
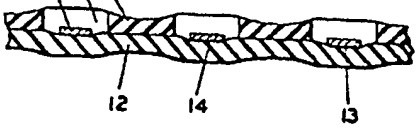


FIG. 4



1028980 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 1 & 2

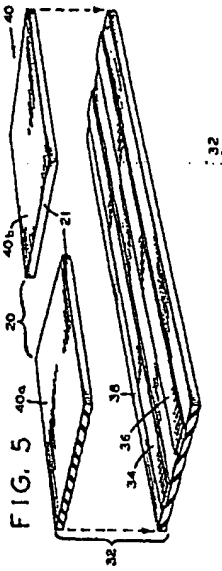


FIG. 5

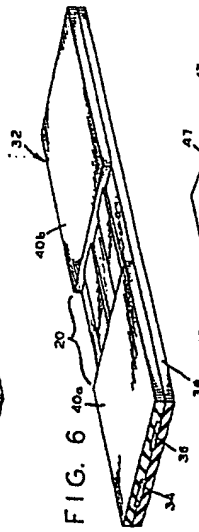


FIG. 6

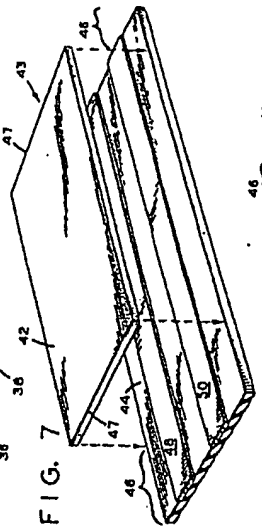


FIG. 7

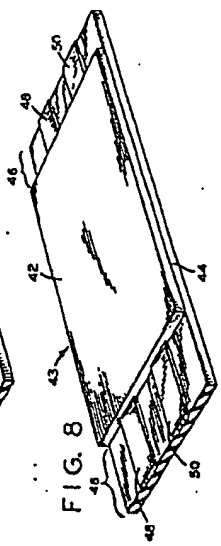


FIG. 8

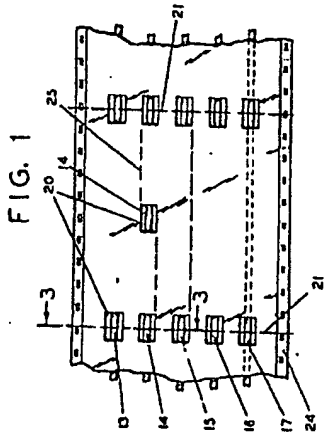


FIG. 1

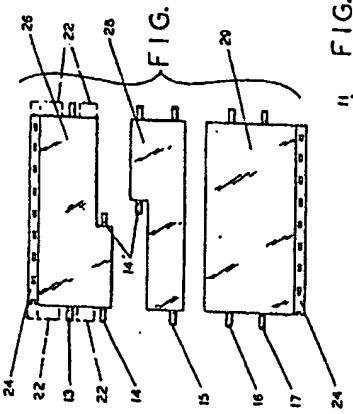


FIG. 2

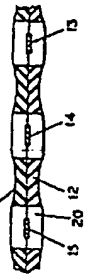


FIG. 3

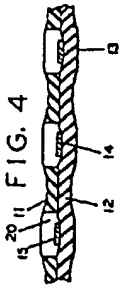


FIG. 4